

# Self-Assembling Wireless Autonomous Reconfigurable Modules (SWARM), Phase II

Completed Technology Project (2006 - 2008)



## Project Introduction

Payload Systems Inc. and the MIT Space Systems Laboratory propose Self-assembling, Wireless, Autonomous, Reconfigurable Modules (SWARM) as an innovative approach to modular fabrication and in-space robotic assembly of large scale systems. Fabrication of modular components yields fabrication savings associated with large production volume and automated integration and test. In-space assembly permits staged deployment on an as-needed, as-afforded basis. It also decouples stowed launch geometry from deployed operational geometry. The SWARM concept uses formation flown spacecraft, containing multiple universal docking ports, to dock with modular elements and maneuver them to dock with other, similar elements. In the process, systems can be assembled that are much larger than what can be fit or folded into a launch vehicle fairing, or what can be launched on a single vehicle. Furthermore, such modularity will allow jettison of failed components, upgrade of obsolete technology, and amortization of design costs across multiple missions. In Phase I, we demonstrated the feasibility of this approach for a simplified telescope assembly on the flat-floor at MSFC. In Phase II, we will develop the hardware and software elements necessary to demonstrate, on a flat-floor, the modular assembly and reconfiguration of systems representative of trans-planetary spacecraft and large telescope assembly.

## Anticipated Benefits

Potential NASA Commercial Applications: This product would have immediate relevance to developers of intelligent modular spacecraft systems, who could purchase a series of modules to assemble a complete spacecraft bus model or, at a lesser scale, component elements (e.g., docking ports). Also because it is inexpensive relative to other associated flight systems, we believe that there could be multiple sales opportunities for the system in the commercial satellite market. DoD applications include the Fractionated Spacecraft Program (F6) and the Tiny independent Coordinating Spacecraft (TICS) program.



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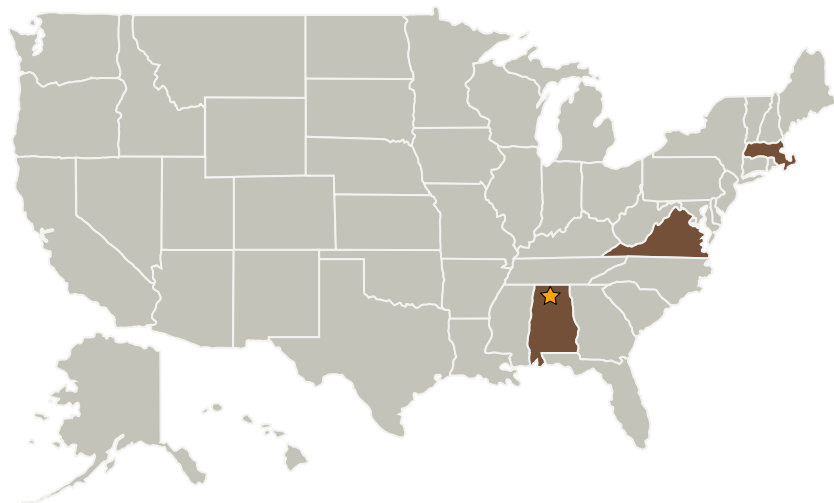
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Aurora Flight Sciences Corporation	Supporting Organization	Industry	Cambridge, Massachusetts

Primary U.S. Work Locations	
Alabama	Massachusetts
Virginia	

## Project Transitions

 **December 2006:** Project Start

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Marshall Space Flight Center (MSFC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Joseph Parrish

## Technology Areas

### Primary:

- TX07 Exploration Destination Systems
  - └ TX07.2 Mission Infrastructure, Sustainability, and Supportability
    - └ TX07.2.4 Micro-Gravity Construction and Assembly

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- ✓ **November 2008:** Closed out
- Closeout Summary:** Self-Assembling Wireless Autonomous Reconfigurable Modules (SWARM), Phase II Project Image